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CONSERVING THE FLORA OF THE PENINSULAR HILLS

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The history of plants of Peninsular India must be viewed in terms of the phenomenon of continental drift (Schuster, 1976). During mid-Cretaceous times India was still attached to Madagascar and lay as far south as near Antarctica (McElhinny, 1968). The break-away and the northward migration started in the Upper Cretaceous, some 75-95 million years ago. By this time the Cordaitales had vanished, but there still were some Ginkgoales, Cycadophytes and Conifers. One wonders if the lone *Decussocarpus wallichianus* found in the Western Ghats today is a surviving member of the ancient lineage (Vishnu-Mittre, 1957) or a recent migrant from the north (Legris, 1963). Of greater significance is the fact that before the start of the migration of the Indian Plate, angiosperms had come into existence in the Lower Cretaceous (Doyle and Hickey, 1976). It is quite possible that during the early days of migration the Indian Plate already had some members of Stylidiaceae besides members of Proteaceae (Schuster, 1976). While the plants were evolving on this Plate, the Plate itself travelled at an average rate of 7.5 cm per year. After more than 40 million years of travel, covering nearly a distance of 5000 km and a latitudinal displacement of about 40°, the Plate reached Laurasia to initiate the orogenic mountain building activities in the Tethyan sea.

THE PRECIOUS HILLS

high altitude Peninsular hills are precious not only because of the migration of this large land mass but also because there are so few areas above 1500 m today. Except the Guru Sikhar in the Aravallis which reaches an altitude of 1722 m (5650′), all other peaks above an altitude of 1500 m are confined to the Western Ghats. Again, while there are peaks in the northern portion of the Western Ghats that reach 1500 m and above (Kalsubai, 1646 m ; Salhar 1567 m) most of the area above this altitude is to be found in the southern regions of the Western Ghats. Here are to be found regions that exceed 2000 m (Vavul Malai, 2339 m ; Berijam 2400 m ; Vembadi 2506 m ; Makurti 2554 ; Vandaravu 2533) and the two highest peaks of Peninsular India, Dodabetta (2637 m) and Anaimudi (2695 m).

Since the shola vegetation is confined to altitudes above 1500 m (4920′), it is instructive to analyse the total area available above this altitude. Judging from topographical maps it appears that some 2000 sq. km of land is above 1500 m. Compared with the more than 2,000,000 sq. km area of Peninsular India this is a mere 0.1%, underlining their importance for retaining them in their original state.

VEGETATIONAL WEALTH

In this scanty area of land above 1500 m has grown a vegetation whose flora is as rich as any other comparable region on earth.

Out of the 672 liverworts in India 225 species are known from South India (Maheshwari *et al.*, 1973). Most of these are confined to altitudes above 1500 m. The fact that 17 species of South Indian liverworts also occur in East Africa is of significance, especially since bryophytes are now proving to be of much value in phytogeographical studies (Schuster, 1976).

Out of the 600 species of pteridophytes in India, 100 are fern allies (Bir, 1976). Besides *Psilotum nudum* and *Equisetum ramosissimum* subs. *debile* (Roxb.) Hauke, *Lycopodium* and *Selaginella* species are also recorded from this region. In Kodaikanal alone Bir and Vasudeva (1971) recorded 14 species of fern allies and 118 species of ferns. Species of *Lycopodium* such as *L. hamiltonii, L. clavatum, L. serratum, L. complanatum* and *L. phyllanthus* have become very rare and are in danger of extinction.

Once very common, species of *Botrychium* (*B. lanuginosum* and *B. daucifolium*), *Marattia fraxinea* and at slightly lower elevations *Angiopteris evecta* and *Helminthostachys zeylanica* are now becoming very rare. In this list should be included *Osmunda regalis* and *Cyathea nilgirensis*.

While 4 of the 6 orders of gymnosperms are recorded from India, higher altitude forms in South India are confined to *Decussocarpus wallichianus* and two species of *Gnetum* (*G. ula* and *G. contractum*). All these are also becoming very rare.

The most interesting vegetation is that of the shola with its rich dense canopy of tall trees. Species of *Eugenia* predominate along with *Michella nilagirica, Ternstroemia japonica, Meliosma wightii, Gordonia obtusa, Elaeocarpus tuberculatus* and some 60 other characteristic species. The outer fringes are occupied by *Rhododendron nilagiricum, Gaultheria fragrantissima* and species of *Strobilanthes*. Inner branches of the trees are covered with epiphytic mosses, lichens, ferns and orchids.

Peninsular India is said to possess an endemic flora of 2045 species of dicots and 500 monocots, as against 3169 dicots and 1000 monocots that are endemic to the Himalayas (Chatterjee, 1962). A partial list of about 100 endemic species of Western Ghats has been provided (Subramanyam and Nayar, 1974). These include the higher elevation monotypic *Baeolepis nervosa, Griffithella hookeriana, Haplothismia exannulata, Jerdonia indica* and *Willisia selaginoides*. There is still much to be learnt about the significance of these endemic species as well as the discontinuous distribution of several others.

THE VANISHING VEGETATION

No account exists of the exact damage done to higher elevation flora. Starting with the occupation of the South Indian Hill Stations by Europeans, the trend of exploiting the hills for economic gain has continued and is now on a seemingly irreversible course which, unchecked will result in the conversion of the entire hill ranges into plantations, agricultural lands and man-made forests.

Tea which was first introduced in the Nilgiris in 1832 has become a profitable industry. At altitudes above 1500 m tea occupies an area of 742 sq. km in South India, displacing, the original shola vegetation. Coffee which was first introduced in 1838 grows well at altitudes between 1000 and 1500 m. Area under coffee cultivation has nearly doubled since 1940 and an estimated 1476 sq. km of land is now under coffee cultivation in South India.

Some of this area border or extend into shola vegetation. Cardamom cultivation which now covers an area of 824 sq. km can also extend to a maximum altitude of 1500 m. Besides these, cinchona, wattle, bluegum and pine plantations, and fruit and vegetable cultivation also take up a considerable ar the Nilgiri District (total area 2549 sq. km) about 1000 sq. km is under cultivation (tree plantations 700 sq. km, tea 220 sq. km, potato and vegetables 80 sq. km). Towns like Ootacamund, Coonnoor and Kodaikanal occupy an area of 150 sq. km.

Such land use implies that as much as 70% of the area above 1500 m has already been cleared of its original vegetation. About 40% of the area above 1500 m is said to be occupied by reserved forests. Here the sholas now occupy only 200 sq. km of land. When compared with the entire Peninsular India this is only 0.01% of the land.

Extensive Grasslands were also part of the higher elevation hill vegetation. These grasslands have been considered by some to be a climatic climax and by others to be a subclimax (Meher-Homji, 1972). We might never know the true nature of the grasslands and the role they have played in the ecology of these hills. For, almost all of the grasslands have been afforested and the grassland afforestation programme is still going on. With the introduction of bluegums, wattles and conifers, much of the natural grasslands have been converted into an highly tainted artificial landscape. The long term ecological ill effects of these plants and their interaction with the native plants are still to be learnt.

With human colonization has come a number of weeds that now pose a threat to the original flora. Perhaps the most noxious of these are *Lantana camara* and *Eupatorium glandulosum*. The latter has made itself so much at home that some have mistaken it for a normal component of the shola vegetation. Mathew (1969) has recorded 346 exotic species of plants to be found in Kodaikanal. As more vegetation is cleared there will be a greater ispread of such aggressive exotics as *Lantana Eupatorium glandulosum, Sarothamnus scoparius, Ulex europeus, Erigeron karvinskianus, Helichyrysum bracteatum, Ageratum houstonianum, Tropaeolum majus, Verbascum thapsus, Oxalis* spp. and several other dicots and grasses.

Overenthusiastic students and teachers of botany as well as biological supply houses have also done irreparable damage to the very species, they should have protected. Amongst these exploited plants are ferns, fern allies, many bryophytes, and such interesting plants as *Lilium neilgherrense* Wight (Plate I) and *Pedicularis perottettii* Benth., apart from the Orchids.

Plate I *Lilium neilgherrense* Wight-
An endangered plant in bloom.

CONSERVATION OF FLORA

The hills and their vegetation are Nature's gift that the world has cherished, and one trusts that the present generation must protect and preserve them for posterity. In their survival is the survival of untold unexploited or underexploited species of economic, medicinal and genetic value.

Among the immediate steps to be taken are measures to declare the shola and neighbouring vegetation as protected by law, considering them as sanctuaries. Botanical Survey of India, Forest Departments and scientists in leading centres of floristic and taxonomic studies should undertake extensive studies to record the endangered species of plants.

Best measure of conservation is proper environmental education. Means must be found to educate every one, through illustrated booklets, documentaries, conferences and guided tours why it is that the world cannot afford to lose even one species out of its seemingly plentiful stock.

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